RMA and India's Military Transformation

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Introduction

The attitudes of the military globally towards revolution in military affairs (RMA) have largely been influenced in recent times by the US Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom in Iraq which have demonstrated the technological prowess of the US military. In the former campaign the employment of Special Operations Forces (SOF) to direct precision air power was a vital component of US operations to achieve rapid success in combination with the Northern Alliance ground troops and it was perhaps the first time that the world saw a transformed US military in action. What was amazing was that the US military was able to project power over very long distances with relatively small numbers of troops.[1]

The operations in Iraq once again provided an insight into a strategy of how relatively smaller number of troops using modern weaponry and networked digitized communications together with integrative technologies (C4ISR) were able to wrap up a military operation with precision and speed. However, there is a down side also because many military analysts point out that the operations in Afghanistan and Iraq are still ongoing and though the new technologies may have greatly assisted the US forces in achieving a quick military victory initially, but they have not been able to secure peace despite increasing the troop strength from

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time to time. While this is true, nevertheless these two wars have spurred the military leadership all over the world to review their military doctrines, organisations, force structures in light of the changes observed in the method of waging conflicts by employing new technologies. The fact is that many nations are discerning that with the rarity of full scale state to state wars, and the future challenges being at the lower end of the spectrum of war, the forces that they have would become more efficient and usable by the adoption of new technologies and new methods of waging wars.[2]

Dilemma Of Indian Military

A survey of India's immediate and strategic neighbourhood highlights the following types of conflicts/violence which are likely to affect security and stability around India, and which may impact on the Indian military's employment and deployment in the future are: Limited conventional conflicts and border wars against traditional adversaries due to territorial disputes and unsettled boundaries, ethnic and sectarian violence, insurgencies, narcotics/drug wars, illegal immigration, religious fundamentalism, terrorism (local and international variety), conflicts which may arise due to big power rivalries, proliferation of nuclear weapons, WMD falling in the hands of terrorists, wars to secure resource areas, and piracy and terrorism at sea, on land and in the air.

Organisational structures for conventional wars/limited conflicts under nuclear over hang already exist but they need to be remodeled, re-equipped & reoriented to conduct joint/integrated battles in digitized battle space and to have the necessary flexibility to undertake other types of operations which lie at the lower end of the spectrum of conflict, at short notice. Additionally India faces serious internal challenges, many of which have risen through bad governance, poor administration, inadequate law and order and rampant corruption. The military may well be required to aid

civil administration to stabilize situations arising due to the above reasons. In essence the Indian military faces greater challenges than any other military in the world and hence needs to study the transformation concepts carefully to cater for the enlarged spectrum of warfare contextually. [3]

Aim

This article examines the key technologies, doctrines and organisational reforms generated by the current IT related RMA and the response of the Indian military so far.

Definitions

Definitions of the ongoing RMA are wide and varied and are dependent on the background, experience and preferences of military analysts. These range from simple definitions explaining the essential nature of the RMA to those that highlight its defining characteristics and those that describe its specific elements. Colin S Gray in his book "Strategy for Chaos" describes RMA differently. He says: "The character of war is always changing, but from time to time the pace of change accelerates or appears to do so with the result that there is a change of state in warfare. War must still be war but it is waged in a noticeably different manner." This is what the current information technology driven RMA has accomplished. [4]

The current revolution has emerged from the developments in the last decade and a half of the Cold War. It has five central attributes: *the ability to strike with precision irrespective of the range; the use of stealth to penetrate defences; the emergence of unmanned warfare; the operational exploitation of space; the ability to move information rapidly across an integrated communication network and exploit effects of joint forces integration.* [5]

Key Technologies

Focus is on military capabilities that make maximum use of modern electronics and computers to improve combat capabilities at modest cost. This philosophy is termed as system of systems approach to military modernisation, as it places less emphasis on major weapons platforms than on what they carry and how they are networked. The key technologies are discussed in the succeeding paragraphs.

Precision-Guided Munitions

Today's precision-guided munitions (PGMs), encompass "smart" or "brilliant" weapons and include a host of weapons that range from missiles to individual warheads to defences against enemy smart weapons. In the US, the Tomahawk cruise missile, guided by the Global Positioning System (GPS), can reliably hit a target the size of a small room from 1600 kilometers (1000 miles) away. The US Army's Tactical Missile System will be able to destroy battalion-sized formations of moving armoured combat vehicles at ranges in excess of 300 kilometres when it is loaded with the Brilliant Anti-Tank (BAT) sub munitions. Combat aircraft today can engage targets with the Joint Direct Attack Munition from a stand-off range of about 100 kilometers and hit their targets by day or night under any weather conditions.

It is reported that the total quantum of PGMs used by the US Army in Vietnam was just 0.2 percent of total munitions; the ratio increased to 8 percent in 1991 Gulf War and rose to 35 percent in Kosovo. In the Afghan and Iraq wars of 2003, 56 percent of munitions were PGMs. These munitions have also enabled the application of "precision force," that offers the possibility of destroying military targets without substantial "collateral," or civilian damage. The US Air Force has phased out almost all unguided bombs in their inventory. Their focus is on acquiring stand off

weapons such as sensor fused weapons (SFW) and low cost autonomous attack system (LOCAAS). SFW consists of ten sub-munitions, each containing four "skeet" anti-armor warheads equipped with passive infrared and active laser sensors. The SFW's sub-munitions descend by parachute, and as they near the ground, they propel their skeet warheads outward in a radial pattern. A single SFW can search for and engage stationary and mobile ground combat vehicles within a 30-acre area. LOCAAS is a 36 inch long, 100-pound, turbine-powered, winged weapon that can loiter over the battlefield for up to 30 minutes and use its laser-radar sensor and rapid automatic target recognition (ATR) capability to identify and track multiple dispersed targets, including tanks, infantry fighting vehicles, missile launchers, and other combat vehicles on the move. The search footprint on the ground of each LOCAAS is over 80 square kilometers.[6]

Stealth

Technological advances in the area of stealth are most significant. Stealthy platforms can penetrate high-threat areas and deliver precision-guided munitions. The US Air Force already has a fleet of stealthy combat aircraft including the F-117 and the F-22 Raptor, the air-superiority fighter. The multirole Joint Strike Fighter, which is now being developed for the US Air Force, Navy, and Marine Corps, for Britain's Royal Navy, and for the air forces of several other countries, will have significant stealth characteristics. It is scheduled for initial deployment by 2010. By that period the US Air Force also expects to field a stealthy Unmanned Combat Aerial Vehicle (UCAV).

The contribution of F-117, the Night Hawk, during the Gulf War in 1991, was quite remarkable. Targets in heavily defended central Baghdad were engaged almost exclusively by the F-117. Not a single F-117 was shot down despite the sophistication of Iraq's air defence network over the

course of some 1,300 sorties. Although this aircraft flew less than two percent of the total attack sorties against Iraq, the F-117 struck nearly 40 percent of the strategic targets and remained the centerpiece of the strategic air campaign for the entire war.

America's nuclear-propelled submarines are the stealthiest in the world. The US navy's next-generation destroyer is expected to be a much larger surface combatant but will have substantially lower signature levels. European navies, in particular the Swedish and French navies are leading the way in surface-ship stealth design. Stealth technologies are also being embraced by ground forces and are slowly making their way into all modern armies' re-equipment programs. For example, the US Army's *Comanche* armed reconnaissance helicopter incorporates "stealthy" features designed to protect the aircraft from visual, radar, and thermal infrared detection. Similarly, Britain's new armoured fighting vehicle, the *Warrior 2000*, has lower thermal and acoustic signatures than its predecessor. This characteristic was discussed in the context of future tank design for the Indian Army during their international seminars on future tanks and infantry combat vehicles in November 2007 and July 2008.

Stealth technology requires continual advances because the current stealth technologies will most likely be defeated within a few years by advances in radar and infrared technologies. Similarly the equipment in use such as stealth aircraft, loose their capabilities through wear and tear caused to their radar-absorbing materials. Exposure to water and humidity also degrades the low-observable enhancing surfaces on the aircraft.

Future platforms may incorporate a new generation of stealth technologies such as active signature nullification; visual signature control using photo chromic, thermo chromic, and electro chromic materials; next-generation stealth coatings, films, and radar absorbent material (RAM); and adaptive "smart skins" that leverage advances in micro electro mechanical systems (MEMS) and bio-mimetic materials.[7]

Battle-space Awareness

The potential of new military technologies to reduce the "fog or war" could change the way wars are fought. Sensors in satellites, manned aircraft, or unmanned aerial vehicles (UAVs) can now monitor virtually everything that is going on in a particular battle area, dramatically improving battle-space awareness resulting in complete "situational awareness" (information of own and enemy troops, terrain and weather characteristics) of commanders at various levels.

Improvements in the GPS satellite navigation network of the US, which now presumably have twenty-eight satellites, compared to sixteen during the 1991 Gulf War, have dramatically improved space-based sensor capabilities. Depending on the nature of the terrain, America's Joint Surveillance Target Attack Radar System (JSTARS), an airborne ground surveillance system, can display the position of vehicles in any weather within an area of two hundred square kilometers. JSTARS upgrades will enable these aircraft to locate, track, and identify vehicles even in mountainous terrain. For surveillance of the airspace, airborne warning and control system (AWACS) aircraft provide surveillance capabilities. The Indian Air Force (IAF) is reported to be acquiring the PHALCON system mounted on Russian IL-76 aircraft from Israel while Pakistan is reported to be acquiring the ERIEYE, airborne early warning and control system (AEW&C) system from Sweden. In view of the future threats and challenges India should also be examining an airborne ground surveillance system linked to a satellite navigation network of defence satellites.

Unarmed aerial vehicles (UAVs) for strategic roles are another area of development which promises to revolutionise surveillance capabilities. The US armed forces are also using them for combat role. Their medium-altitude, long-endurance *Predator* UAV and the high-altitude *Global Hawk* UAV can loiter on station for twenty-four hours or more and provide

specific imagery within a few minutes of the request. Both have been tried out in operations in Afghanistan and in Iraq. Indian armed forces are in a nascent stage in this context. They have acquired the Searcher and the Heron UAVs from Israel and have developed Nishant indigenously but these are designed purely for tactical surveillance. Induction of unarmed combat aerial vehicles (UCAVs) would become mandatory in the future for the variety of challenges that are likely to face India in the plains as well as and in the mountains. India also must learn to fight without necessarily putting boots on the ground on all occasions. Strategic and operational compulsions may dictate adoption of such methods.[8]

Command and Control Architecture

The most significant technology in the current RMA is the one which increases battle-space awareness. Enhanced awareness can only be acquired by "digitising" the battlefield. That is to say, digital technology is built into aircraft, tanks, artillery, and individual soldier systems, with the intention of providing commanders with "situational awareness", an instantaneous and complete picture of the battlefield. The US army has already fielded it first digitised division, the Fourth Infantry Division (Mechanised) in Iraq. Enhancing battle-space awareness together with a command and control architecture to act on information received requires advanced command, control, communications, computers and intelligence processing (C4I) systems. Automation of command and control systems, have incrementally moved from C3I, to C4I, C4 ISR (SR stands for surveillance and reconnaissance) and now C4I2 (Intelligence and Interoperability) SR in order to meet the demand for real time, robust, reliable and efficient command and control systems. By reducing the information-decision-action loop to a matter of minutes, advanced command and control systems have the potential to allow a commander to control a battle from one moment to the next. This will also result in "information dominance" of the battlefield and confer battle-winning advantages.

A recent interview of the Director General Information Systems (DGIS) of the Indian Army, conducted by the author, and published in SP's Land Forces 4 of 2008, is revealing regarding our aspirations and the extent of progress in the army which is also somewhat indicative of the overall progress in this field. The DGIS states:

"Indian Army is in a phase of transition from conventional warfare to information enabled warfare i.e. from platform centric to network centric warfare. The full realisation of any such revolution is possible only with technological development, organisational adaptation, and most importantly a national will. An effective and technologically sound IT force along with robust communication networks has been created to facilitate real time sharing of information and quick decision making so as to achieve information superiority. A road map has been formulated by which we can progress steadily towards being a potent IT force. We have identified the development of C4I 2 systems as a major thrust area for modernisation of our army. Development and fielding of automated operational and information systems for various levels of operations from Army Headquarters to Battalion headquarters to individual soldiers are in progress. Command Information and Decision Support System (CIDSS), Artillery Command, Control and Computer System (ACCCS), Battlefield Support System (BSS), Air Defence Control and Reporting System, and Battle Management System (BMS) are the major projects under development. Integrated together with requisite communications, these systems will provide near real time "Sensor to Shooter" links to make army a network centric force.

Interoperability between the three Services is a problem facing not only the Indian Army but many other armies the world over. Since the systems were conceived and developed in stand alone modes, their integration into a system of systems in a seamless manner is a

technological challenge. We are working in the direction finding appropriate solutions to that and a common network centric operations philosophy is being worked out. The integration at Headquarters Integrated Defence Staff level is ensuring the interoperability and synergy at the inter-services level."

Progress in most projects mentioned above is very slow and the interoperability with other services is presently not on the horizon. Therefore time critical targets will inevitably suffer from delayed engagement. Limited technological comprehension at higher levels, short tenures of project managers due to career enhancement requirements of the armed forces, inadequate private industry participation and Army's natural conservatism in taking advice from non-government sources, are some of the drawbacks which are adversely affecting the entire process of transformation.[9]

Doctrinal changes

Joint Doctrine

The RMA is bringing about an increasingly integrated battlefield, because technology is achieving the synergy and objectives of combined arms operations and joint operations. The army, navy and the air force will be able to work more closely together despite their usual turf driven differences which prevent them from achieving the requisite jointness/integration. Future scenarios will see air force shaping the battlefield for ground forces and being more responsive to ground forces requirements. Airlift assets will transport troops to the theatre of operations. Manned, unmanned, and satellite surveillance platforms would operate throughout the campaign, supporting all three services, while naval forces could provide offshore logistical support, sea lift, and precision fire capabilities against ground targets. "Jointness" refers to

increased operational integration among the various components of the armed forces, whereas "combined" operations involve the military services of various countries working together. This trend towards joint and combined operations will necessitate *interoperability*. Indian armed forces have just begun examining this phenomenon.[10]

Naval Aspects

The key shift in naval doctrine is towards littoral warfare. Naval experts expect that most future contingencies will require the navy to project force "from the sea," directly ashore, whether in the context of a regional war or a peacekeeping operation. Land-attack cruise missiles which were earlier considered as strategic weapons are now being employed to strike tactical targets ashore. India Navy has the Brahmos and the KLUB missiles but their range is limited. US navy is developing the Land Attack Destroyer to provide precision firepower in support of ground troops and marines. The littoral region is a perfect battleground for joint warfare, because effective operations in this environment require the navy to work closely with the army.

Another important doctrinal change is a shift from platform-centric to network-centric warfare. This concept places emphasis on the sensor and surveillance systems of a group of warships, submarines, or aircraft, rather than on the particular attributes of the platform itself. Critical to this approach is the timely exchange of data among many diverse platforms, in order to reduce reaction time to an absolute minimum and deny the enemy a window to respond.

Indian Navy hopes to acquire a full spectrum maritime capability which would encompass defence of the Indian Peninsula up to the Indian Ocean Rim, against all contingencies; defence of own sea lanes of communication (SLOC) and ability to interdict enemy SLOC; dominate

enemy's littoral and engage in joint operations against the littoral; protect our sea borne trade, our energy security; security of 7,516 km of coast line and EEZ of over 3 million sq km, and acquire the naval component for the expeditionary force and for out of area tasks.[11]

Land Warfare Aspects

While land wars will continue to dominate the region, their conduct and manner of employment of forces needs to be examined. The unpredictable nature of the threats in today's international security environment together with the technological advances necessitate that military forces have the ability to respond quickly to almost any situation. This, in turn, demands smaller, more mobile and flexible ground forces that are still highly lethal. This will be possible with enhanced reconnaissance and surveillance systems integrated through communications to weapon systems with precision-guided munitions. However the Indian military in the regional context faces the additional threat of conventional conflicts, waged in the backdrop of a nuclearised environment, against traditionally hostile adversaries. Such wars are likely to be also accompanied by low intensity conflict involving insurgencies and terrorism and other forms of irregular warfare (non-traditional modes of warfare). The Chinese call it war beyond limits or "Unrestricted Warfare" where the aim is to implode a state from within. This has also been termed as fourth-generation warfare by William Lind.[12]

The transformation of the Indian army will involve a change from industrial age army, trained, equipped, and postured to undertake conventional offensive and defensive operations to an information age army capable of simultaneously fighting high intensity conflicts together with insurgencies and terrorism which may be home grown or sponsored by states or powerful non-state actors or a combination there of. Simultaneously it will have to guard against cyber attacks, bio agents and

media manipulation and other forms of irregular warfare. While the above activity is being undertaken at short notice, the nation may well be involved in UN peacekeeping and peace enforcing operations as a part of an ongoing UN mandated operation. Thus the combat capabilities of the armed forces have to cater for hybrid forms of war including some in which there are no recognised rules of warfare. Hence, organisations will have to be flexible to adapt themselves to the required situation which will demand greater skills from the officer cadre and the soldiery at all levels. Here the noteworthy aspect is that the combat capabilities of army units and formations can be multiplied with information age technologies which could confer greater warfighting capabilities on smaller combat formations, thus eliminating the need for large troop build-up in the conflict area. Future capability will result from the ability to quickly reduce the ambiguity of a situation, to respond flexibly, and to use force, where necessary, with precision and accuracy.[13]

Air and Space Aspects

With the advent of precision guided munitions combined with accurate reconnaissance, surveillance and target acquisition systems and GPS aided navigation systems; modern technology has given airpower the capability of destroying targets with single digit CEP and with least amount of collateral damage. The effects of air power in high intensity battles are fundamentally greater than before. Given the wherewithal these characteristics endow air power with the ability to psychologically and physically imbalance an opponent and sometimes even achieves strategic aims set by the national leadership with highly selective employment of land forces. However while the air force can make material contributions to and significantly shape operational success, their claims about primacy of air power are overstated. Kosovo viewed objectively is a better case for the capacity of adaptive adversaries to negate technical edge and preference for stand off warfare. Afghanistan was another case where air

power made remarkable contributions. Precision strikes with the help of a small contingent of US Special Forces gave rise to claims of pin point bombing. But overall this conflict reinforced the lessons of Kosovo. One cannot afford to overlook the role of Northern Alliance which compelled the Taliban to flee or ignore the Tora Bora operations where due to lack of ground forces Al Qaeda members were able to make good their escape into neighbouring Pakistan. The utility of air power varies across different types of conflicts. If state to state wars are going to become a rarity in the future, then there will be no state infrastructure to provide a large number targets for destruction, then air power will be reduced to being, a strategic deterrent. Where warfare becomes diffused the employment of air power will become highly selective thus reducing the so called air power dominance. On the other hand in high-intensity combat, air power will shape the battlespace such that the main role of land forces would now be to secure a victory, rather than achieve it.[14]

Military experts predict that the coming military revolution will also witness the militarization of space, with warfare occurring in space as well as on land, at sea and in the air. To counter these developments the US Army has developed and tested a ground based satellite weapon system involving a powerful laser.[15] China's new anti-satellite weapon, demonstrated on January 11, 2007, destroyed a Chinese weather satellite 865 km above Earth. Similarly on 20 Feb 2008 the USS Lake Erie launched a Standard Missile-3 which traveled at 17,000 mph over the Pacific Ocean to destroy a non-functioning National Reconnaissance Office satellite. Future threats to satellite systems could include satellites armed with lasers, as well as electronic jamming devices and viruses that could shut down the flow of information.

Organisational Reforms

Successful conduct of war requires responsive, well-trained and well-led units and formations whose organisation is designed to defeat the opponent

based on the new technologies, new weapon systems and new command and control architecture. Military experts often point out that the invention of the tank did not bring about an armoured warfare revolution until Germany had placed it in the context of a Panzer division, a combined arms organisation built around the tank ably supported by artillery, engineers, and infantry. Today's organisational transformation requires that with the shift from "mass destruction" to "precision warfare" comes a parallel shift from mass armies to smaller, more highly educated, and capital-intensive professional armed forces whose units are commanded by a more decentralized decision-making structure and can be specifically tailored to the task at hand. The emphasis on high-quality weaponry has reduced the relative importance of numbers and placed a premium on high-quality troops.

A major shift in the organisational structure will be at the decision making levels. So far we have been used to the bureaucratic organisation which has dominated the industrial age. This has to give way to decentralised decision making of the information age. The army for instance may have to de-layer itself by removing certain headquarters; say for instance the division headquarters. The Corps can directly command Brigade Groups which are smaller in size and self sufficient in all respects and have equal if not greater amount of fire power due to networking of all entities. The division headquarters can be retained for peace time coordination, administration and training.[16]

Response of the Indian Armed Forces

One can quite confidently state that with the current RMA a "strategic moment" has arrived. While everyone acknowledges that war must still be war, yet all seem to feel that it must now be waged in a noticeably different manner. The fact that all three Services are excited about Network Centric Warfare (NCW) is evident from the statements of the Chiefs of all three Services which have been appearing in the media from time to time.

NCW also known as information based warfare is the product of convergence of certain key technologies such as computers, communications, sensors and precision fires and their exploitation to bring to bear maximum combat power at the right time and the right place. NCW uses information for the benefit of the soldiers in peace and in war. The military calls it "situational awareness" which implies awareness regarding terrain [including objectives/targets], weather, enemy, and own forces. This information is passed from the sensors deployed on the ground, at sea, in the air and in space [satellites, unmanned aerial vehicles, aircraft, radars etc] through broadband digital communication networks to front line units and the decision makers in the rear in real/near real time frame thus making the battlefield transparent and reducing the response time.

Military literature in the US describes network centric operations (NCO) as high tempo, precise, agile style of manoeuvre warfare focused on Effects Based Operations [EBO] that derive their power from robust networking of geographically separated entities. EBO themselves are coordinated sets of actions directed at shaping the behaviour of friends, foes and neutrals in peace, crises and war. This implies timely, appropriate and skillful use of all or selected element[s] of national power which include political/diplomatic, economic, technological, social, psychological, information/media and military among others. The final aim is to achieve strategic [political] objectives of war with the least amount of tactical effort which incidentally is also the essence of "Operational Art". Hence "jointness" and "integration" together with innovative Operational Art are vital ingredients of this type of warfare.[17]
The four fundamental requirements [capabilities] for conducting NCO are Networked Communications, Information Sharing , Advanced Information Technologies such as Decision Support Algorithms etc. and Networked Enabled Platforms [vehicles, tanks, ships, aircrafts and other weapon systems].

So what is the status of Indian armed forces as far as this IT generated RMA is concerned? Are we close to achieving the desired capabilities or is it only on our wish list currently? The fact remains that the Indian armed forces are neither integrated nor do they possess these capabilities, regardless of some "stand alone" capabilities existing within each service. Our desire to acquire NCW capabilities, in the first stage, is laudable, but if we wish to move along the path of an Indian RMA, our promises must be backed by agencies and agents for implementation. The military instrument of NCW will have to be forged on suitably joint/ integrated organisations, new technologies, seamless communication networks, joint operational concepts, doctrines, and training and jointly evolved procurement/manufacture of all important weapons and other systems and attitudinal change on part of the leadership to accommodate the new RMA and to substantially improve the skills of all ranks for the type of warfare envisaged. We are continuing to develop and plan exclusively (single service planning), still aspiring to induct high technology systems of the future from Russia, France, USA, Israel or UK in the "stand alone" mode in each service without seriously examining their interoperability and suitability as network platforms and without proper fusion of systems both inter and intra-service into a system of systems so as to derive full benefits of the synergy so acquired.

Technology

Indian armed forces are facing an entirely new technology era, generated through advancements in the field of miniturisation, digitization, material science, biotechnology, sensor technology, stealth, communications and information technology. India needs to integrate new technologies as warfighting systems for which the requirement is to simultaneously evolve a new joint warfighting doctrine and concepts of joint warfighting and then decide upon the weapons and other systems to suit the former. Employment of joint/integrated task forces in the future would require, in

the first instance, introduction of three critical technologies namely: Long Range Precision Firepower; Integrative Technologies (C4I2); and Intelligence, Surveillance and Reconnaissance [ISR].[18] In acquiring the above systems and technologies our progress is extremely slow. We need to take advantage of our new found friendship with the US and the western world to acquire hardware and technologies from abroad if our own scientists cannot develop them.

Nine Steps to Achieving Transformation

Military analysts have established that RMAs of all kinds, of any magnitude, and in any period are likely to share a common structure with common structural -functional dynamics. *Colin S Gray* in his seminal work on RMAs in "Strategy for Chaos" explains nine steps in the RMA process which could assist the Indian Armed Forces in their NCW project.

- Step 1 - "Preparation", implies that RMAs occur following lengthy periods of reform and extensive preparatory work is necessary.

- Step 2 - "Recognition of Challenge" explains that RMAs occur for a wide variety of reasons judged important. They are a manifestation of radical political – strategic reorientation which in our case was provided by the Kargil conflict and Operation Parakram.

- Step 3 – "Parentage" in that RMAs to be successful require political clout or the patronage of those with political clout. A case in point is of the information - led RMA of 1990s in the US where Andrew W Marshall was the intellectual parent and patron who was keenly supported by the Secretary of Defence William J Perry and Vice Chairman of the Joint Chiefs of Staff, William A Owens.

- Step 4 - "Enabling Spark" implies that an RMA like NCW has to be constructed by revolutionary effort and for this a vital "enabling spark" is needed which may be individuals or a vital invention.

- Step 5 - "Strategic Moment" spells out that RMAs typically contain a Strategic Moment which reveals, as in a flash of brilliance, new and exciting strategic possibilities. Such moments by themselves may not be the main event but they provide the hint of what may be feasible.

- Step 6 – "Institutional Agency" explains the need for RMAs to have agencies and agents for implementation. These include appropriate military organisations and with suitable military cultures, joint doctrines and innovative operational concepts derived through "Operational Art" and intensive training.

- Step 7 - "Instrument" describes that not only do the RMAs have to be conceived and forged but their military instruments also have to be procured. Regardless of the potency of the military instrument it has to be of a size which is appropriate for executing operational concepts in the Indian context.

- Step 8 – "Execution and Evolving Maturity" clarifies that the only test that really counts, in the pragmatic world of strategy, is the detailed consequences of the use of the RMA i.e. its trial by combat. This step essentially refers to the military and strategic effectiveness achieved by implementing the RMA.

- Step 9 - "Feedback and Adjustment" must have the potential of fuelling a complete renewal of the RMA cycle.[19]

The nine steps explained above are just an analytical tool and could be termed as a conceptual tool kit for understanding an RMA process such as the NCW. It needs reiterating that this phenomenon, involves much more than mere networked communications. In fact it involves a totality of systems which can be abbreviated as C4I2SR [command, control, communications, computer, intelligence, interoperability, surveillance and reconnaissance]. Armed forces would do well to study this phenomenon carefully and conduct the developmental process through tri-service integrated enquiry, research and analysis to arrive at contextual frameworks and structures for NCW. A brief and objective survey will highlight the weaknesses in each step of the structural dynamics in the Indian context.

Conclusion

The change and transformation in Indian armed forces will require fundamental attitudinal change on the part of the military to accept and absorb the changes and to educate the political leadership so that they become stakeholders along with the military in the transformation process. The nature of wars in the future is going to compel us to think big but with smaller, more maneuverable, more precise and more agile forces. The appointment of a Chief of Defence Staff to coordinate and propel the transformation process forward at the highest levels has now become a greater necessity. *idsa*

Notes

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